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MINERALS AND INTERNATIONAL RELATIONS

THE INTERNATIONAL RELATIONSHIP OF MINERALS

and

INTERNATIONAL MOVEMENT OF MINERAL PRODUCTS IN PEACE AND WAR

By Sir Thomas H. Holland, K.C.S.I., K.C.I.E., D.Sc., LL.D., F.R.S.

Vice-Chancellor and Principal of the University of Edinburgh

JANUARY, 1931

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PREFACE

The significance of raw materials in international relations which has been steadily increasing since the beginning of the industrial era in time of peace, becomes in time of war a matter of life and death. This is true in highest degree of minerals.

It is useful that students of international affairs be thoroughly well informed on the past history, the present situation and the future prospects of the trade in minerals between nations and of the results which may be expected from a wise control of this trade both in peace and in time of possible war.

Perhaps no one is better qualified to inform public opinion on this subject than Sir Thomas Holland, author of the two articles which follow. During the World War, as Chairman of the Indian Industrial Commission and President of the Indian Munitions Board, he made a record of exceptional achievement and had unique opportunity to demonstrate the possibilities of rapid and effective development of mineral resources in time of severe stress. As Vice Chancellor and Principal of the University of Edinburgh, Sir Thomas Holland needs no introduction to readers of *International Conciliation.*

NICHOLAS MURRAY BUTLER

New York, December 15, 1930.

THE INTERNATIONAL RELATIONSHIP OF MINERALS*

BY

SIR THOMAS HOLLAND, K.C.S.I., K.C.I.E., LL.D., D.Sc., F.R.S.

President of the British Association for the Advancement of Science

A few years ago Members of this Association looked forward annually to a generalised statement of the results of their President's own research work in science. The rapid specialisation of science, with its consequent terminology, has, however, made it increasingly more difficult in recent years for any worker to express himself to his fellow-members.

Last year at Glasgow most of us expected that the hidden secrets of crystals would be revealed by one whose capacity for popular exposition accompanies a recognised power for extending the boundaries of science. Instead, Sir William Bragg released his store of accumulated thought on the relationship of science to craftsmanship in a way which gave each specialised worker an opportunity to adjust his sense of relativity and proportion.

If I attempted now to summarise my scattered ideas on the outstanding problems of micro-petrology, I might possibly find half a dozen members charitably disposed to listen, and of them perhaps one might partly agree with my theoretical speculations. We have indeed to admit that the science of petrology, which vitalised geological thought at the end of the last century, has since passed into the chrysalid stage, but, we hope, only to emerge as a more perfect imago in the near future.

Coincident with the excessive degree of specialisation which has developed with embarrassing rapidity within the present century, the problems of the Great War drew scientific workers from their laboratories and forced them to face problems of applied science of wider human interest. And the atmosphere of

*Address delivered in Johannesburg on July 31, 1929, at a session of the joint meeting of the British and South African Associations for the Advancement of Science held in South Africa, July 22—August 3, 1929. Reprinted from the *Report of the British Association for the Advancement of Science*, 1929.

this great mining field[1] stirs ideas of this wider sort—ideas concerning a field of human activity which, in recent years, has affected the course of civilised evolution more profoundly than seems to be recognised even by students of mineral economics. This must be my excuse for inviting you to consider the special ways in which the trend of mineral exploitation since the War has placed a new meaning on our international relationships.

With knowledge of the shortcomings which were felt during the War, in variety as well as quantity of metals, it was natural immediately after to review our resources, with the object in view of obtaining security for the future. But events have since developed rapidly, both in international relationships and in mineral technology. The evolution of metallurgy during the present century, and the developments in mining on which metallurgy depend, have placed new and rigid limitations on a nation's ability to undertake and maintain a war; consequently, the control of the mineral industries may be made an insurance for peace. Let us first consider briefly how these circumstances have arisen, how each country has passed from the stage of being self-contained in variety of essential products to the most recent of all developments, the change to large-scale production that has tended to the concentration of the mineral and metal industries to certain specially favoured regions which will hold the position of dominance for several generations to come.

The names of Isis, Cybele, Demeter and Ceres seem to suggest that the ancient theologians in different lands formed the same conception of those peculiar conditions in pre-historic times which made it likely that a woman—tied for long periods to the home-cave—rather than a man, was the one who first discovered the possibility of raising grain crops by sowing seed. Whoever it was who first made this discovery was the one who diverted the evolution of man along an entirely new branch, and so laid the foundation on which our civilisation was subsequently built—the beginning of what Rousseau called "Le premier et plus respectable de tous les arts."

Compared with this economic application of observational science, the later inventions, which seem so important to us—explo-

[1]The Witwatersrand.

sives, printing, the steam engine—were but minor incidents in the evolution of civilised activities. Previous uncertainty regarding the supply of the products of the chase, and the dangers which were necessarily attached to the collection of berries and edible roots in the jungle, became less important to the family man when it was found possible to raise food supplies nearer home. This discovery was thus not one of merely material advantage; for it necessarily led to the idea of storage, and so opened up a new mental outlook for primitive man.

But then this new possession of field crops—the acquisition of cultivated real estate—created fresh cares and new anxieties, which contained the germ of future political problems. In addition to the previous dangers from nomadic hunters and predatory carnivora, new troubles arose from other enemies—herbivorous animals, birds, insects, droughts and floods.

The formation of village groups for protection, and the development later of tribal communities resulted necessarily in the radial extension of field "claims"—what our modern politicians, with careless disregard for geometrical terminology, now call "spheres of influence"—always dominated by the extending necessities of agriculture, the growing of crops for food and then, with the scarcity of skins, for textile materials.

The mineralogist and the metallurgist were perhaps before the farmer among those earliest research workers in applied science; but they were small folk, mere specialists in science. They have obtained a place of undue prominence in the minds of our modern students because of the adoption of their products for purposes of terminology in our conventional time scale for those ages that preceded history. But this is due merely to the durability of implements as index "fossils," and is in no sense a certain indication of their political and industrial importance.

And then afterwards, long afterwards—indeed, up to historically recent times—national boundaries became extended or were fought for, but still mainly because agricultural products in some form were a necessity for the maintenance of communal life. When British traders first went to India, for instance, they extended their influence first along the navigable rivers for the trade in vegetable products which were raised on the alluvial lands

around; and so British India, as we call it today to distinguish the administered areas from the residual native States, is now mainly agricultural. Even when the permanent settlement of Bengal was made in 1793 no one thought of reserving for the State the underlying coal which has since become so surprisingly important. It was the field, and the field only, that was considered to be of commercial and political importance.

Agricultural products, therefore, until recently dominated the political ambitions of national units. Whether, and to what extent, the possession and use of mineral resources may now modify that dominant spirit is the principal question to which I wish to invite your attention this evening.

In the evolution of man, as in the evolution of the animals that occupied the world before him, there are no sharply defined, world-wide period limits: the pre-agricultural Bushman still survives and lives the life of pre-agricultural man in this Union of South Africa. The recognition of agriculture as a leading inspiration for acquiring and holding territory has been modified occasionally by "gold rushes" into lands previously unoccupied, but they have generally had a temporary, often a relatively small, importance. The "gold fever" may be what our lighter species of newspaper calls "dramatic," but a fever is a short item in the life of a healthy man; heat waves do not make climates. Possibly our school children are still told that Australia is noted for its gold fields, but the whole of the gold produced there since its discovery in 1851 is less in value than that of three years' output of Australian agriculture.

Even here in South Africa, which produces half the world's supply of gold, the value of the metal is still less than that of the pastoral and agricultural products. It is true that gold and diamonds introduced temporary diversions in the political expansion of South Africa, but the dominant interests of the Union are still determined by the *boer-plaas* and the *weiveld*.

The adventures of the Spanish *conquistadores* in the sixteenth century and of their enemies, the sea-roving Norse buccaneers, were inspired by stories of gold in El Dorado. And yet the whole of the South American output of gold, even under its modern development, is almost negligible beside the pastoral and agricul-

tural products—wheat, maize, wool, tobacco, coffee, cocoa, sugar, meat and hides. The total production of gold for the whole continent last year was worth no more than a hundredth part of the surplus of agricultural products which the Argentine alone could spare for export. Truly there is a substantial difference between the bait and the fish, between the sprat and the mackerel.

The discovery and colonisation of a continent are not the only ways in which the lure of gold has often brought results more valuable than the metal itself. The efforts of philosophers from the time of the Alexandrian Greeks in trying to transmute the base metals into gold resulted in accumulating the raw materials with which Paracelsus laid the foundations of a new chemistry.

Metals, we know, have been used since early times for simple implements and weapons, but it was not until the industrial revolution in Great Britain that the mechanisation of industries led to any considerable development of our mineral resources, first slowly and with a limited range of products, then on a large scale and with an extended variety.

But to distinguish clearly cause from effect is not always simple. We were told at school of the remarkable series of inventors who laid the foundation of the textile industries in the north of England, and of the timely invention of the steam engine; its application to mine pumping; the successive construction of the steamer and the locomotive; the production of gas from coal. But the close association of ore, fuel and flux made it possible not only to improve machinery, but to increase facilities for the transport of raw materials and their products. When Josiah Wedgwood obtained his inspiration from the remains of Greek art, then being unearthed from the ancient graves of Campania, he first turned to account the raw materials of his native county of Staffordshire, and then promoted canal and road construction to introduce the china clay from Cornwall.

It is obvious that the growth, if not with equal certainty the origin, of the industrial revolution was due to the close associatian of suitable minerals in England. It was because non-phosphoric ores were still available that, at a later stage, Bessemer was able to give that new impetus which increased the lead of the English steel maker; and so, when Thomas and Gilchrist came

still later, with their invention of a basic process applicable to pig iron made from phosphoric ores, their invention fell on barren soil in Britain. The new process, however, found applications elsewhere, and, instead of adding to the stability of the English steel industry, it gave the United States the very tonic they required, whilst the industrialists of Germany—where political stability had by then been established—found the opportunity of developing the enormous phosphoric ore deposits of Alsace-Lorraine, which had been borrowed from France eight years before. And so it was through the genius of Sidney Gilchrist Thomas, and his cousin, Percy Carlyle Gilchrist, that Germany was enabled in 1914 to try the fortune of war.

For the first half century after the industrial revolution, Great Britain was able to raise its own relatively small requirements of iron as well as of the other metals that consequently came into wider use—copper, zinc, lead and tin. The rapid expansion in steel production which followed Bessemer's announcement of his invention at the Cheltenham meeting of the British Association in 1856, brought with it the necessity of going further afield for the accessory ores and for further supplies of non-phosphoric iron ores.

The next important step in metallurgical advance came in 1888, when Sir Robert Hadfield produced his special manganese steel; for this led to the production of other ferro-alloys, and so extended our requirements in commercial quantities of metals which were previously of interest mainly in the laboratory—vanadium, tungsten, molybdenum, aluminium, chromium, cobalt and nickel. The adoption of alloys, especially the ferro-alloys, at the end of the last century opened up a new period in the newly established mineral era of the world's history; for, beside the increase in the quantity of the commoner base metals which were wanted for the growing industries of Great Britain, it was necessary now to look further afield for supplies of those metals that had hitherto been regarded as rare in quantity and nominal in value.

The country in which the industrial revolution originated and gathered momentum, because of the close association of a few base metals, could no longer live on its own raw materials, and never again will do so. Even in peace time Great Britain alone

consumes twice as much copper and just as much lead as the whole Empire produces. Meanwhile, developments had occurred elsewhere, notably in Germany, where political stability had been secured, and in the United States, where the Thomas-Gilchrist process also had stimulated expansion. Thus, by the beginning of the twentieth century, the industrial activities of the world had entered a new phase, which was characterised, if not yet dominated, by the necessity for minerals to maintain the expanding Arts of Peace.

From this time on no nation could be self-contained; a new era of international dependence was inaugurated, but the extent and the significance of the change was not consciously realised by our public leaders until 1914, when it was found that the developments of peace had fundamentally changed the requirements for war. Indeed, not even the German General Staff, with all its methodical thoroughness, had formed what the tacticians call a true "appreciation of the situation." Two illustrations of short-sightedness on both sides are sufficient for the present argument. Up to the outbreak of war, although the wolfram deposits of South Burma were worked almost entirely by British companies, the whole of the mineral went to Germany for the manufacture of the metal, tungsten, which was an essential constituent of high-speed tool steel. Sheffield still occupied a leading place in the production of this variety of steel, but was dependent on Germany for the metal, which the Germans obtained mainly from British ore. Under the compulsion of necessity, and without consideration of commercial cost, we succeeded before the middle of 1915 in making tungsten, whilst Germany, failing to obtain an early and favourable decision in war, used up her stocks of imported ore and turned to the Norwegian molybdenum for a substitute, until this move again was partly countered by our purchase of the Norwegian output. Germany then found that she wanted ten times more nickel than Central Europe could produce; so she imported her supplies from the Scandinavian countries, and they being neutral, obtained nickel from another neutral country, where the Canadian ores—the world's main source—had hitherto chiefly been smelted and refined. We thus realised, not only our dependence on other lands for the essential raw minerals,

but we had the mortification of finding that, through our own previous shortcomings in the metallurgical industries, we were compelled to face lethal munitions made of metal obtained from our own ores.

The political boundaries of the nations, originally delimitated on considerations dominantly agricultural in origin, have now no natural relation to the distribution of their minerals, which are nevertheless essential for the maintenance of industries in peace time as well as for the requirements of defence. This circumstance, as I hope to show in the sequel, gives a special meaning to measures recently designed on supplementary lines in Europe and America for the maintenance of international peace, measures which, as I also hope to show, can succeed only if the facts of mineral distribution become recognised as a controlling feature in future international dealings.

If minerals are essential for the maintenance of our new civilisation, they are, according to the testimony of archaeology and history, worth fighting for; and if, according to the bad habits which we have inherited from our Tertiary ancestors, they are worth fighting for, their effective control under our reformed ideas of civilisation should be made an insurance for peace. In so attempting to correlate the facts of mineral distribution with questions of public policy, there is no danger of introducing matters controversial; everyone here must agree on two things, namely, our desire and even hope for international peace, and consequently the necessity of surveying the mineral situation as developments in technological science change the configuration of the economic world.

Since the industrial revolution in Great Britain, the increase of mechanisation and consequent consumption of metals had been accelerated with each decade, it is not necessary to quote the statistical returns available for estimating the rate of this acceleration, for it can be expressed in a single sentence which justifies the serious consideration of every political economist: during the first quarter of this present century alone, the world has exploited and consumed more of its mineral resources than in all its previous history, back to the time when Eolithic man first shaped a flint to increase his efficiency as a hunter.

To save you from the narcotic effect of statistical statements, I will limit myself to one illustration of this generalised statement; for this special example not only illustrates the rate of general acceleration in exploitation, but introduces an important subsidiary question, namely, the way in which activity is becoming pronounced, if not substantially limited, to a group of special areas. In the year 1870 the United States produced 69,000 tons of steel; in 1880, 1¼ million tons; in 1890, 4¼ millions; in 1900, 10 millions, and in 1928, 45 millions.

Figures like these raise questions regarding the future which would take us beyond our present thesis. For the present we can assume with fair confidence that, taking the world as a whole, the depletion of natural stores is not yet alarming, although the rate of acceleration, by reason of its local variation, forces into prominence some international problems, which will influence, and if effectively tackled will facilitate, the efforts to stabilise conditions of international relations.

I have elsewhere[2] made estimates of the quantities of metals stored in that part of the outer film of the earth's crust which may be regarded as reasonably accessible to the miner. The actual figures in billions of tons convey no precise mental impression to us, and need not be quoted here, but certain of the outstanding conclusions have a bearing on our present line of argument.

The first feature of surprising interest to the man in the street is perhaps the relative abundance of those metals with which he is familiar in the Arts—copper, lead, tin, zinc and nickel. Nickel, in spite of its price and limited use, is twice as abundant as copper, five times as abundant as zinc, ten times as abundant as lead, and from fifty to one hundred times as abundant as tin. There are, indeed, among the so-called rare metals some which are distinctly more abundant than lead, although this is the cheapest of the lot in price, and is consumed at the rate of over a million tons a year.

And so one gets at once an indication of two important features. Firstly, the miner works only those deposits in which the metal is concentrated sufficiently to make their exploitation a profitable

[2]Presidential Address, Institution of Mining and Metallurgy, *Trans.* Vol. XXXIV 1925, p. LVII.

business; and secondly, the metalliferous ores vary greatly in the completeness with which they have been concentrated in special places to form workable ore-deposits. Nickel-ore, for instance, occurs under conditions which conspicuously hinder its freedom of local concentration; and consequently the wide distribution of the metal and its relative abundance bring little comfort to those who are anxious about their supplies of a metal which jumps suddenly into importance with every rumor of war. We are safe in predicting that we shall never recover for use in the Arts any fraction of our total supplies of nickel as large as we shall of most of the others which have been mentioned. Indeed, nickel stands apart from the others; for, whilst it is important in peace time and is dangerously important during war, yet, under the present state of mining and metallurgical practice, the deposits in the world worth working for nickel can be numbered on the fingers of one hand, and nine-tenths of our supplies come from a single district in Canada.

Before discussing more precisely the significance of this and similar facts on the question of international relationships, let us consider for a moment the nature of our exploitation methods. Our reference to nickel shows that the metalliferous ores vary in their degrees of concentration, and, therefore, in their suitability for working; but, as the result of estimates made for a few common metals, we shall not be far from the average in assuming that we shall never recover more than about one-millionth of the total that lies within workable distance from the surface of our accessible dry land. And another conclusion, based on a similar group of calculations, shows that our greatest total tonnages are not contained in the rich deposits but in those of low grade.

It follows, therefore, that every advance in metallurgical science and in mining technology that makes it possible to work our low-grade ores adds appreciably to the actuarial value of civilisation; for our mineral resources can be worked once and once only in the history of the World, and when our supplies of metalliferous ores approach exhaustion, civilization such as we have now developed during the last century must come to an end. When a miner raises a supply of ore in concentrated form for the metallurgist, he damages, and so places beyond reach forever, far larger quan-

tities of residual ore than he makes available for use. When a metallurgist takes over the product of the miner and separates the refined metal for use in the Arts, he also incurs serious losses, although not to the same extent. There are thus before both the miner and the metallurgist opportunities for extending the actuarial value of civilisation; and because the cost of labour is the principal constituent in the total bill, and has recently swamped contemporaneous advances in technology, the gradual elimination of manual labour by mechanisation is obviously the most profitable line of research.

But mechanisation carries with it in general a tendency to limit operations to the larger deposits, with the concurrent neglect of those propositions which are widely scattered over the earth, and, though individually small, represent in the aggregate a serious section of our limited resources. And so our operations in mining, with the family of industries dependent on minerals, tend more and more to be restricted to a few special regions, where work can be done on a large scale.

So now, with this thumb-nail sketch of the way in which the new mineral era is developing, we are free to examine more closely the influence which this change in the configuration of the industrial world is likely to have on international relationships.

In the first place, it becomes obvious that no single country, not even the United States, is self-contained, whether for the requirements of peace or for the necessities of war. Not even the more scattered sections of the Earth that are politically united to form the British Empire contain the full variety of those minerals that are the essential raw materials of our established activities.[3] Between them these two—the British Empire and

[3]For purposes of reference I give a list of minerals, showing how the resources of the British Empire, so far as our present information goes, can be relied on. This list has been kindly revised by Mr. T. Crook of the Imperial Institute.

1. *Those for which the World now depends mainly on the Empire*:—Asbestos, china clay, chromite, diamonds, gold, mica, monazite, nickel and strontium.

2. *Those of which we have enough and to spare*:—Arsenic, cadmium, cobalt, coal, fluorspar, fuller's earth, graphite, gypsum, lead, manganese, salt, silver, tin and zinc.

3. *Those in which we could be self-contained if necessary*:—Bauxite, barium minerals, felspar, iron ore, magnesite, molybdenum, platinum, talc, tungsten and vanadium.

4. *Those for which we are now dependent on outside sources*:—Antimony, bismuth, borates, copper, petroleum, phosphates, potash, pyrites, quicksilver, sulphur and radium.

A corresponding list for the United States was prepared in 1925 by a Committee under the chairmanship of Prof. C. K. Leith, and published under the joint authority of the two Mining and Metallurgical Institutions in New York.

the United States—produce over two-thirds of the 2,000 million tons of mineral that the world now consumes annually. Each of them has more than it wants of some minerals; but, in order to obtain its own requirements at economic rates, each finds it necessary to sell its surplus output to other nations. Each produces less than it wants of some minerals, and so must obtain supplies from other nations to keep its industries alive. Each of them is practically devoid of a few but not always the same minerals, which, though relatively small in quantity, are none the less essential links in the chain of industrial operations. Even if these two could "pool" their resources they would still be compelled to obtain from other nations the residual few. For it is important to remember that unlike organic substance, it is not possible to make synthetic metals, and it never will be; it is not even possible to make artificial substitutes for many essential minerals that are used as such and not merely for their metallic constituents. There is no other mineral and no artificial substance for instance that can combine the qualities which give to the mineral mica its position of importance in the Arts—its fissility in thin sheets, its transparency to light and opacity to heat rays, its stability at high temperatures, its toughness and the degree of its insulating properties. There will never be a synthetic mica.

Thus the international exchange of minerals is an inevitable consequence of our new civilisation; and the cry for freedom of movement, for the "open door" and for equal opportunity for development comes into conflict with the unqualified formula of "self-determination." Whatever may have been possible before the industrial revolution, when the mineral industry merely contributed to the simple wants of agriculture, when most national units were self-contained, the formula of "self-determination" has come too late in the World's history to do good without a more than consequent amount of harm. We cannot even live now without the free interchange of our minerals for those of other nations; in the name of civilisation we dare not go to war.

There is one more group of fundamental data to recall before we are in a position to point the practical lessons which follow from the newly established and prospective mineral situation. I have already referred to the way in which economic considerations

tend, through large-scale production, to restrict operations to a limited number of specially favoured areas. There was a time within my memory when the primitive *lohar,* a survival of the aboriginal inhabitants of India, could be found in every province, nearly every district. He collected the granular mineral from the weathered outcrops of relatively lean iron-ore bodies, and, by using charcoal as a fuel, turned out blooms of malleable iron in a miniature clay furnace, using a pair of goat skins to produce the necessary blast. These primitive workers also produced small ingots of steel by the carbonisation of wrought iron in clay crucibles many centuries before the same process made Sheffield famous.

But with the large-scale production of steel in western countries, attended by the opening of the Suez Canal, cheaper transport by steamers and the spread of railways from the coast of India, the *lohar* has been exterminated from all but the most remote parts of the country. His history is similar to that of other workers; the small ore bodies that he used are of no interest to the modern iron master, and one result therefore of the modern movement is the neglect of a large fraction of our total resources. We are discussing, however, what is actually happening, not what we think should be a less wasteful course of evolution; natural evolution, like "trial and error" methods, is always wasteful.

Primitive workers in various lands have opened up to relatively shallow depths rich but small deposits of other ores, and in eastern countries especially, where forms of civilisation extend far back into history, the numerous and wide-spread "old workings" have given rise to travellers' impressions of great mineral wealth. But low-grade deposits that the ancient miner could not utilise are now opened up by mechanical methods on a large scale; and, on the other hand, what satisfied the primitive metallurgist in abundance would be of little use to the modern furnace.

We have now to revalue the tales of travellers which have had a dangerous influence on those who have directed the course of international competition; we have to strike out of consideration the integers of the primitive worker to whom a great tonnage would form a mere decimal point in the modern unit; we have to realise that our mid-Victorian standards of metal production

are gone forever, and that the comforting after-war formula of "back to normal" is merely a hypnotic drug to conceal the uncomfortable, one might say regrettable, dynamic conditions which have since developed at a speed that is not sufficiently recognised within the Empire.

It is now misleading to speak of the wide distribution of minerals within a country as we could have done some fifteen years ago; we must now rule out the smaller deposits, and so form a new picture composed of those concentrations that are on a scale sufficient to support modern metallurgical units.

For this reason it is necessary to review afresh the resources of the undeveloped Far East, which has for many years been regarded as a menace to western industrial dominance. The vague general notion that mineral deposits are evenly distributed throughout the Earth's crust has fed the impression that the development of China, which is much larger than the United States, may yet shift the centre of industrial gravity when her great population becomes awakened and organised by western technical science.

It is true that the people of the East are rapidly adopting the methods and using the mechanical facilities of western nations—railways, telegraphs, power factories, steel ships and other metal-consuming devices; but the critical investigations made by mining geologists, especially since the War, tend, with a striking degree of unanimity towards recognising the remarkable circumstances that China, as well as other countries of the Far East, is deficient in those essential deposits of minerals on which our mechanised form of civilisation is based.[4]

When China was still an unknown land it was possible for after-dinner speakers to impress non-critical hearers by talk of the "yellow peril" and the "challenge of Asia"; but these expressions have been used without thought of the circumstances that natural resources in minerals now sets a rigid limit to power, whether industrial or military. We have known for some time of the natural limitations of India, of Japan and of smaller political units in the East; but until very recently we have had

[4]A comprehensive study of this question with bibliography has recently been published by a competent and judicial authority, H. Foster Bain: "Ores and Industry in the Far East," 1927.

insufficiently precise data for estimating the quantitative value of the terms "vast" and "unlimited" which have been so often applied to China. Assuming that China may yet become a homogeneous national unit, or even assuming that her resources may become developed by Japanese energy, there is very little doubt now that, as an industrial area, the country is deficient in those minerals that form the essential basework of the modern form that civilisation has definitely taken.

And the obvious limit in development, as defined by local natural resources, can be extended only to a limited degree by the importation of raw materials from other areas; for a country can buy metals only by the exchange of other products; its buying powers are limited by its selling powers. Abundant cheap labour, assisted by a semi-tropical climate, can produce an exportable surplus of food stuffs only in limited parts of the Far East; even the so-called luxury products, which to our early navigators formed the inspiration of what we call geographical research, are now obtained elsewhere, and some are being replaced by artificial products evolved from the chemical laboratory.

Exploratory work by mining geologists tends more and more to show that the essential mineral products are far from evenly distributed over the land areas of the world. Western Europe and North America have an undue share of those deposits that can be worked on a large scale, and it is the large-scale movement that marks the specialised character of the new industrialism. Anglo-Saxon character would have found limited scope for its energy but for the fact that nine-tenths of the coal, two-thirds of the copper and as much as 98 per cent of the iron ore consumed by the world come from the countries that border the North Atlantic. Dr. Wegener might like to add this fact to the data on which he has based his theory of drifting continental fragments.

The industrial revolution, which began in Great Britain, has always been recognised as a dominant phase in western civilisation, but is now assuming a new character. It spread first to the western countries of Europe, and developed there because of the favourable conditions of mineral resources, but the force of the movement faded out towards the Slavic East and the Latin South; the mechanical industries of Italy are based on imported scrap.

When the new industries became transplanted west of the Atlantic the natural conditions which originally favoured Great Britain were found to be reproduced on a larger scale.

Thus, in these two main areas, separated by the Atlantic Ocean, a family of industries based on mineral resources has arisen to dominate the world; for no similar area, so far as our geological information tends to show, seems to combine the essential features in any other part of the world. Other parts of the world will continue to supply minor accessories; and the isolated basic industries associated with coal and iron will supply local needs on a relatively small scale. But political control, which follows industrial dominance, must lie with the countries that border the North Atlantic.

It is only in this region that there is any approach to the state of being self-contained. And yet since the war there has arisen, first in Europe and then by imitation in Asia, a degree of national exclusiveness more pronounced than any which marked international relations before 1914. Each small political unit has become vaguely conscious of the value of minerals, and has shown a tendency to conserve its resources for national exploitation on the assumption that they add appreciably to military security.

There is, however, no such thing now as equality of nations in mineral resources; "self-determination" and the "closed door" are misleading guides to the smaller nations. Political control may hamper, but cannot stem, the current of the new industrialisation; commercial and industrial integrations are stretching across political boundary lines; and the demand for the interchange of mineral products will be satisfied in spite of fiscal barriers.

It would have been a shock to our members if, before the War, political problems were discussed from this Chair, and party politics may always be inconsistent with the mental products of culture. But the results of science and technology now limit the effects of national ambitions, and therefore dominate the international political atmosphere for good or evil. One is justified always in suggesting non-controversial measures that tend to good; and this it is proposed to do very briefly as the direct suggestion of the new configuration of the mining and metallurgical world.

The League of Nations has accomplished a large measure of international understanding in questions of social value; its influence in forestalling possible causes of war has raised new hopes; but fortunately, so far, it has not been compelled to use any such instrument of force as a blockade, and any such measure that clashed with the vital economic considerations of first-class powers would probably cause stresses well beyond its elastic limits. The more recent and simpler Pact of Paris associated with the name of Mr. F. B. Kellogg wants equally an ultimate instrument for its practical enforcement.

It was with this ultimate object in mind that the outline of my argument was drafted after the Glasgow meeting last year; but I am glad to find that my views have since been expressed independently. Senator Capper, of Kansas, in February last submitted a resolution to the American Legislature recognizing this shortcoming of the simple treaty, and proposing to supplement its moral obligations by a corollary which, if passed, will empower the Government on behalf of the United States to refuse munitions to any nation that breaks the multilateral treaty for the renunciation of war.

Senator Capper's resolution, however, still leaves unsolved a residual problem of practical importance. Those of us who had the painful duty of deciding between civil and military necessities in the Great War, know well that there is now but little real difference between the materials required to maintain an army on a war footing and those that are essential to the necessary activities of the civilian population; *materials* essential for one purpose can be converted to *articles* required for the other. Thus, if Senator Capper's resolution be adopted by those who have signed the Pact of Paris, either sympathy for the civil population would be stirred, or the armies would be still supplied with many essential munitions: the definition of "conditional contraband" would still remain as a cause for international friction.

A formula, still simpler but equally effective, is indicated by this review of the new situation arising from the essential use of minerals. It is suggested, therefore, as an amendment to Senator Capper's resolution, that the simple words "mineral products" be substituted for "arms, munitions, implements of war or other articles for use in war."

The only two nations that can fight for long on their own natural resources are the British Empire and the United States. If they agree in refusing to export mineral products to those countries that infringe the Pact of Paris, no war can last very long. As our friends across the Atlantic have recently learnt, it is easier to stop exports than to prevent imports; the Customs' officer is more effective, less expensive and far less dangerous than a blockading fleet.

The confederation of American States has the advantage of forming a compact geographical unit, without inter-State fiscal barriers to hamper the interchange of mineral products. The British Empire, in the words of Principal Nicholas Murray Butler, "has passed by natural and splendid evolution into the British Commonwealth of Nations"; it is composed of geographically scattered and independent political units, among which freedom of interchange, with due regard to local interests, can be effected safely only by more complete knowledge of our resources. Next year the Empire Congress of Mining and Metallurgy will meet in this city to discuss the proposition which I submitted to it at Montreal in 1927; and this address must be regarded, therefore, as an introduction to a movement which one hopes will supply the necessary data, and so facilitate a working agreement between the two great Mineral Powers that alone have the avowed desire and the ability to ensure the peace of the world.

INTERNATIONAL MOVEMENT OF MINERAL PRODUCTS IN PEACE AND WAR*

By Sir Thomas H. Holland, K.C.S.I., K.C.I.E., D.Sc., LL.D., F.R.S.

Vice-Chancellor and Principal of the Edinburgh University

"The building of the institutions of peace is the most distinctive enterprise of our time. We are still in the preliminary stages, engaged in the study of architectural drawings and blue prints, with much disagreement. We are contriving to live in a partial and frail structure with incomplete and inadequate facilities while we seek to perfect our plans. We are troubled about the foundations of our edifice, as borings show pockets of quicksand, in national policies, age-long antagonisms, and developing rivalries. Even the materials at our command are fragile and hard to solidify to such a degree as to give assurance of being able to withstand the fierce storms of passion which are not unlikely to recur. The difficulties do not make the task any the less the supreme task of modern civilisation, for, *unless we measurably succeed in it, that civilisation will destroy itself as it brings the discoveries of science and the improvements of invention to the operations of war in both weapons and methods.* We shall have to build and rebuild, and then mayhap build again, but the constructive processes must go on." (Hon. C. E. Hughes: Address to the American Society of International Law, Washington, April, 1929. Reprinted as Senate Document No. 19; 71st Congress, 1st Session, June 17th, 1929.)

Introduction

Very few Societies did more than this in assisting the "discoveries of science and the improvements of invention" to reach that stage of development which enabled them to be perverted to frightfulness unheard of before the Great War. Few of our Fellows did more to assist the activities of this Society than the one whose memory is kept green by this annual lecture; but now, in the name of Trueman Wood, I offer by way of some compensa-

*The Trueman Wood Lecture, delivered in London at the Tenth Ordinary Meeting of the Royal Society of Arts, January 29, 1930. Reprinted from the *Journal of the Royal Society of Arts*, Vol. LXXVIII, February 14, 1930.

tion to the builders of "the institutions of peace," a contribution to the architectural designs referred to by Mr. Hughes—a suggestion that our knowledge of science should be turned to better account and designed to secure peace, even by the inhibition of war.

To establish the importance and the significance of the international movement of minerals, it seems essential to depart from our old custom of limiting a subject to its purely technical aspects. Our Society has always had in view the commercial implication of technology and science; but our commercial ideas till recent years have been generally national in scope. That limited phase of our activities is now out-of-date; our membership is no longer English or even British; nor can any discovery or invention now remain purely national. Of that we have been conscious for many years; but we have now to learn also that even our mineral resources cannot be conserved for purely national uses.

One of the earliest products of after-the-war political thought was the development of an intense and narrow form of nationalism—the result of the use of a plausible catch-word, "self-determination." Whatever its value may have been for the readjustment of national boundaries in the pentacostal assemblage of races in south-eastern Europe, this principle has since been inconveniently extended to justify an extreme form of conservation of mineral resources within the boundaries of each national unit.

Two developments in opposite directions have marked the progress of science during this century. Firstly, specialisation has tended to cut off from one another workers in different branches of science; they have found it increasingly difficult to follow one another's results and even one another's terminology. Secondly, the marked influence of science on public questions has forced our workers to leave their laboratory problems in order to take an interest in matters of wider human interest; and no branch of science has now a greater influence on questions of public policy than that of mineral economics.

Germany was enabled in 1914 to challenge the other great European powers because of the technical developments which followed Thomas' and Gilchrist's invention in 1878 of the basic

process for the smelting of phosphoric iron-ores. The Central Powers collapsed in 1918 because of the circumstances which partly, perhaps mainly, grew out of their shortcomings in mineral supplies.

During the War, those who were responsible for our munitions supplies were made painfully conscious of the circumstance that not even the resources of the whole Empire were sufficient, in variety or in quantity, to meet the ultimate military demands; and consequently some of us commenced soon after the War to undertake the task of reviewing our resources, in the hope, which soon proved to be futile, of finding the Empire to be self-contained.

In this country a discussion was initiated by the Institution of Mining and Metallurgy in April, 1927, and the papers[1] then considered were referred to the Empire Congress of Mining and Metallurgy which met at Montreal in the following August.

The Institution of Petroleum Technologists at the same time inaugurated a discussion on the question of oil supplies.[2]

With a similar object in view a Committee under the chairmanship of Professor C. K. Leith was established in 1921 for the United States by the joint action of the American Institute of Mining and Metallurgical Engineers and the Mining and Metallurgical Society of America. The studies of this Committee and of the Sub-Committees which dealt with special minerals were published in 1925.[3]

Following the issue of this Report a series of papers were published by Professor C. K. Leith in the American quarterly review, *Foreign Affairs*.[4]

[1] "Proposed Review of the Mineral Resources of the Empire," by Sir T. H. Holland.
"Observations upon Mining Law in the Empire," by Gilbert Stone.
"Mica in Its International Relationships," by G. V. Hobson.
"The Empire's Tin Resources," by R. Pawle.
"The Organisation and Work of the Mineral Resources Department of the Imperial Institute," by Sir R. Redmayne. (*Transactions, Inst. Min. Met.* Vol. XXXVI.)

[2] "Conditions affecting the Petroleum Prospects of the Empire," by Sir T. H. Holland.
"Economics of the Petroleum Situation," by Sir F. W. Black.
"Progress and Prospects of Production," by E. H. Cunningham Craig.
"Petroleum Refining within the British Empire," by J. McC. Sanders.
"Possible Auxiliary Sources of Liquid Fuel," by A. W. Nash. (*Journ. Inst. Petrol. Tech.*, Vol. XIII, 1927, pp. 617–681.)

[3] International Control of Minerals, New York.

[4] See especially "The Political Control of Mineral Resources," July, 1925; "The Mineral Resources of the Far East," April, 1926; and "Exploitation and World Progress," October, 1927.

National Interdependence for Mineral Supplies

Among all the results that emerged from these various studies there was one about which practically no difference of opinion arose; it is the one which is of most immediate significance to our present theme; it is fundamentally important, whether we consider the question of tariffs, the conservation of resources for possible future use, or the control of mineral movements during a state of war. It is to the effect that no single country is self-sufficient as regards the variety and the quantity of the mineral resources that are required, either for the maintenance of civil activities in peace-time, or, therefore, for meeting the much greater requirements of war.

The two American mining and metallurgical societies, when publishing the findings of the Leith Committee, authorised the following covering comment:—

> A study of these papers will be most illuminating as showing how little can nations stand alone, any more than can men; how greatly is our material prosperity and our standard of living dependent on far-flung trade, and how even our great United States in its continental sweep is not self-contained in its minerals.

Even if we could similarly treat the whole British Empire as a national unit, the same remarks would hold good, in spite of its much greater total area, the widely scattered positions of its constituent parts, and the greater amount of its land which has not yet been completely surveyed by mineral specialists.

There is, however, one more geographical area that may some day form the nidus of a national unit, namely, the mysterious Chinese part of the "Far East," with its little-known natural resources available to a population of patient, industrious workers that have been likened to a nest of ants. China is larger than the United States, and is a compact land-area, varied in geological features—a country which before the War we might have regarded as rich to any possible degree in mineral resources. But during the past ten years several propositions, which were previously known vaguely, have been examined critically by mining geologists; and one by one they have failed to show any assemblage of complementary constituents on which to base a family

of metallurgical industries such as we are familiar with in the countries bordering the North Atlantic ocean.

Mr. H. Foster Bain, the distinguished American mining engineer, who has examined many "promising" deposits in China, and has made an extensive study of its industries generally, has summarised his own observations and those of other explorers in a way that practically settles all doubt about the nature of the supposed "yellow peril."[5] Professor E. F. Gay, of Harvard University, summarised his impressions of Mr. Bain's studies as follows:—

> "No modern country can be self-sufficient, but, with this serious limiting factor, least of all can the countries of the Far East, as they become modernised, be economically independent. Their growing nationalism—an inevitable and desirable development—may find bounds set, both for peace and war, by multifarious needs for railroads, steamers, machine-equipment, which can be satisfied in their fuller extent only by importation and the resulting ever-closer international relationships. Gradually developing those manufactures which can be exchanged for the essential metal products, and struggling with an even more difficult food problem, the countries of the Far East must, it would seem, become steadily more dependent upon those regions which are technically more advanced and in minerals much richer."

Before postulating as a basic fact that no country is self-contained in the matter of mineral resources, it may be well to anticipate one inevitable form of criticism, namely, that there are still large areas of the world which have not been surveyed in sufficient detail to justify a negative conclusion of the sort. We must admit that to a certain degree this is true: it is true, too, that several important discoveries of ore have been unexpectedly made by accident, and that some such local surprises[6] are yet probable; it is true that we know little about Central Africa and the hinterland of China; it is true that a mineral deposit of great local value may be an inconspicuous feature in a jungle-covered area of the tropical belt, or in the forest lands of Canada and Siberia.

[5] "Ores and Industry in the Far East," published by the Council on Foreign Relations, Inc., New York, 1927.

[6] For example, the copper-nickel deposits of Sudbury in Canada, and the iron-ores of Chota Nagpur and Orissa in India may be regarded as surprises of the sort.

But during recent years, and especially during the last decade, the area of such possible surprises has been markedly narrowed, not only for particular minerals, but more especially for assemblages in variety sufficient to maintain those families of industries that are necessary to establish national independence. We know enough now to be practically sure that no geographical unit controlled by any one nation will ever be found to equal the British Empire for variety, or the United States for quantity of essential mineral products. As Professor Leith has said, "Changes will still be made by discovery, usually in expected fields, but the main outlines are now pretty well fixed. The curve of geographic discovery is falling. The great discoveries of the future will in the main relate to better methods of recovery and use."[7]

And against this chance of surprise through further discovery of concealed mineral deposits, we must place the recent tendency towards large-scale production, which is putting out of effective action many deposits that were formerly treated as of local importance. Further deposits of local importance will doubtless be discovered, but there is little hope of finding any assemblage that will establish another great industrial power.

That we are living in an era which above all previous ages is dependent on minerals is generally appreciated; but that a new period in that era, marked by large-scale operations, has opened with this century is less generally recognised. In the latest quarter century of its history "the World has exploited and consumed more of its mineral resources than in all its previous history, back to the time when Eolithic man first shaped a flint to increase his efficiency as a hunter."[8] This consumption is proceeding at an accelerating rate, and the large-scale period of the mineral era is now showing even another new phase, tending towards the geographical restriction of large-scale exploitation to a few limited areas that are specially endowed with those basic metals and fuels on which the web of modern industry is based.

The mineral deposits of the World are the outcome of a complex natural process of segregation and local concentration which has been going on for geological ages within the Earth's crust;

[7] "Exploitation and World Progress," *Foreign Affairs*, New York, October, 1927.
[8] Holland. Presidential Address to the British Association, 1929, p. 16.

and those which are rich enough at accessible depths are exploited to maintain the modern form of civilised activities. The corresponding processes of ethnographic segregation and concentration which have resulted in the formation of national units have marked out a quite different set of geographical boundary lines.

Although many expeditions for conquest have been inspired by prospects of gold and precious stones, the actual colonisations of undeveloped new land, as well as the determination of boundary lines for the older nations, have been established mainly because of agricultural interests. The lands that are most suited for agricultural development do not necessarily cover the areas that contain workable mineral deposits; indeed, more often the mineral-bearing regions are not well suited to cultivation, and consequently this late phase of economic expansion, based on the utilisation of mineral products, has upset the old-established political equation; new conditions have now to be faced.

In parts of Europe since the War, the political units which constitute nations have even become sub-divided and more sharply defined under the influence of "self-determination" applied in the ethnographic rather than in its economic sense. The political desire to become self-contained is fostered without regard to the fact that modern industrial activities compel the movement of mineral products from one country to another. The industries of Great Britain, for example, could not now be carried on without copper from foreign sources; for this small country consumes, even in peace time, twice as much of the metal as the whole Empire now produces.

By reference to a few examples it is possible to form an idea of how the World's industries would be affected if the chief suppliers of minerals wished, and were able, to prohibit exports in accordance with a policy of conserving their resources for possible needs in the future:—China supplies about two-thirds of the World's needs of antimony.[1] The British Empire produces 90 per cent of the asbestos supplies, and 63 per cent of the chromite. Canada and the Belgian Congo share practically the whole output of cobalt. The United States produce half the World's supplies

[1] As a guide to these approximate fractions, I take the official figures for 1926 to 1928, which are now nearly complete for the countries referred to (see Table on p. 51).

of copper. More than half the production of gold is South African. Of the pig-iron produced, over three-quarters is smelted in the countries bordering the North Atlantic. Over one-third of the lead is raised in the United States. India and the Gold Coast between them produce one-third of our supplies of manganese-ore. India and Brazil share about equally the output of monazite. Canada produces 90 per cent of the supplies of nickel. The United States raise seven-tenths of the petroleum supplies. Adjoining fields in Germany and France produce over 90 per cent of our potash. About one-half of the quicksilver is obtained from Spain. Nearly half the tin ore raised is from British Empire sources, one-third being from the Malay States. Of the 1 2/3 million tons of zinc obtained in 1926, over half-a-million tons came from the United States, and nearly one-third of a million was British in origin.

It is obvious from these rough figures that the World's industries could be dislocated at any time by a selected series of prohibitions or prohibitory tariffs under normal peace-time conditions, whilst any Great Power could be hampered, and in most instances practically paralysed, if cut off from the rest of the World during war. Germany, for example, depends almost entirely on foreign sources for her supplies of aluminium, antimony, asbestos, chromite, magnesite, manganese, mercury, nickel, petroleum, phosphates, sulphur, tin, tungsten and zinc; and has insufficient natural supplies to meet her domestic demands for copper, iron, lead and mica. France has a still longer list of deficiencies; she could raise her own bauxite for aluminium, iron-ore and potash with some to spare, but has insufficient antimony, coal, magnesite and phosphates, whilst she is dependent almost entirely on foreign chromite, copper, lead, manganese, mercury, mica, nickel, petroleum, tin, tungsten and zinc. Even the United States would be embarrassed if cut off for long from foreign supplies of antimony, chromite, magnesite, mercury, mica and tungsten, and they depend almost entirely on outside sources for asbestos, high-grade manganese-ore, potash, nickel and tin.

Although Great Britain has a surplus of coal for export, it could not, at normal prices during peace-time, supply its own needs in any of sixteen minerals just mentioned, except possibly

iron-ore, of which, however, high-grades are conveniently imported from the countries on the eastern shore of the North Atlantic, the amount so obtained being about half that raised in Britain. If, however, one takes into account as well the produce of the Dominions and dependencies, there would be enough of all, except antimony, mercury, potash, petroleum and copper, whilst, as regards the last-named two, British capital controls foreign sources sufficient just to cover ordinary needs. The surplus available for export of some of these minerals puts the Empire—if regarded as one political unit—in a position to dominate the markets of the World.

Italy can meet its own needs in aluminum, mercury and zinc, but would be embarrassed seriously if cut from outside supplies of any of the other minerals quoted. The mechanical industries, which have reached such a high degree of efficiency in Italy, are mainly dependent on imported scrap; and thus are more vulnerable than those of countries which can raise temporarily their own requirements of raw materials.

Japan can spare some sulphur for export, and under peace-time conditions might be self-supporting for copper, zinc, and perhaps mica; but could not from her own natural resources provide any serious fraction of the full requirements for war.

War Conditions

It is obvious that Germany had realised before the War the importance of mineral supplies, and had reckoned on accessory sources that will never be available in future. Germany seized at once some parts of France and thus secured her increased wants in iron-ore and coal, with the metallurgical facilities of Belgium. She could count on the import of tin from the Dutch East Indies, with Holland as a neutral; she could for the same reason get aluminium from Switzerland, and, with little risk of interruption at sea, some nickel, copper and molybdenum from Scandinavia; she also had accessible the resources of Austria, Roumania, Bulgaria and Turkey for graphite, petroleum and magnesite. And yet the absence of the few minerals which were still essential was sufficient ultimately to precipitate the end; even with these ex-

tended areas the Central Powers were still embarrassed from 1915 onwards.

At the commencement of the War, nickel of Canadian origin was refined largely in the United States and was thus free for export, without challenge as contraband, through Scandinavia to Central Europe; but, before the end of 1915 the shortage of nickel became serious; even the 5-pfennig coin had to be withdrawn and replaced by iron, and when the "Deutschland" returned from America, in September, 1916, with a small consignment of 325 tons of the metal, there was national jubilation over the success of the trans-Atlantic submarine excursion, forgetful of the circumstance that this was merely a small, though dramatic, incident showing the disquieting efficiency of the blockade. Economy in copper was enforced as a further necessity in the replacement of brass by iron, even for weights; and then later the shortage of phosphates, previously obtained from Curacoa, Tunis and Florida, began to tell on the agricultural output of food supplies. The story of tungsten has often been related as an instance of short-sightedness on both sides; it is not necessary to repeat it here; for, whether embarrassment was due to one, two or more minerals, matters little for the present argument, so long as the missing minerals were essential for war activities in the accustomed sense.

One of the most interesting of these war illustrations was afforded by the mineral cryolite, which is used in the electric smelting of aluminium, and occurs only in one place in the world, namely, in Greenland, a Danish possession. The crude mineral was refined at Copenhagen, and this source of supply was even more important to the Western Allies than to the Central Powers, for Germany was able to make artificial cryolite. Thus, Denmark, as a neutral, held a powerful key-industry which could be used, if necessary, as a serious embarrassment to the Allied Nations.

Schemes Designed to Ensure Peace

It is now obvious from what has been said that the distribution of mineral deposits which is independent of any national boundary lines, has a commanding influence on the conditions of war; and it is this circumstance that might be turned to account as a means for giving effect to the two recently established agreements

for the maintenance of peace—the League of Nations and the Pact of Paris.

We can safely assume that, in spite of these efforts to develop international understandings and in spite of even the formulation of treaty obligations, there is still some danger of a war developing on a large scale between Great Powers. So long as the Great Powers maintain armies and navies on the present scale, it seems justifiable to regard this assumption as inevitable and necessary. Agreements to limit naval building, such as that now being discussed by the representatives of the five principal Powers, assembled here in London, have admittedly some economic value in reducing the financial burden of armaments, but they have less value as an insurance of peace. It is true that competitive naval building provokes a war atmosphere; indeed, every military and naval tactician is liable to be influenced by the feeling that it is foolish to have an efficient warlike machine unless it be used.

To some extent the reduction, or even an agreed limitation of armaments, makes for a consciousness of unreadiness, and therefore tends psychologically to keep the military advisers of all nations more or less in a modest frame of mind. But the very existence of a trained army and a well-equipped navy of any size indicates a significant want of international trust and confidence; they are therefore potential dangers. Everyone remembers, too, that, soon after the Great War started, our navy, to some extent, and our army, enormously, was expanded, not only beyond the scale which was planned by military strategists, but many times beyond any scale ever thought of previously as necessary or likely.

One cannot hope that in the near-enough future the great nations will reduce their military machinery to negligible proportions by mutual agreements of the sort that are now being attempted. Nor, so far as my argument is concerned, is it necessary for them to effect such reductions. The scheme suggested in the sequel is designed to inhibit the use of any armament, large or small, during a threatened or actual breach of international peace.

The problem has been to find some form of practical veto which can be put into operation without the danger of collateral international complications—complications of the kind that would follow, say, interference with the freedom of the seas, or the

declaration as contraband of articles and materials that would seriously affect commerce and finance. For a maritime nation these would require a fleet in sufficient strength to effect the legal search of neutral shipping during War.

Any forcible interference with neutral shipping incurs always the danger of extending the area of the war zone; we had many instances of this during the Great War before the Americans came in on the side of the Allies. More than once there was a danger of America getting off the fence on the wrong side. Then, too, the exercise of restraint in this matter meant that we probably sometimes allowed conditional contraband to get through rather than run the danger of further complications with neutrals. For example, we were well aware of the fact that Canadian nickel matte was sent to the United States for refining, whilst the refined metal went from there to Scandinavia and thence to Germany to be used against our own armies.

And that illustrates the very difficult question of *conditional contraband;* that is, articles or materials that during a war might be turned to account as munitions, although ordinarily used for purely civilian services. In the old days the definition of contraband was relatively easy, because the articles almost entirely, and the materials mostly, which were wanted as munitions, were very specialised and could easily be defined. The last War demonstrated that any such distinction between materials wanted solely for the army and materials wanted for essential civilised activities were similar and interchangeable up to some nine-tenths of the total. What an army now wants in the field is similar to a large extent to what the civil population *must* have to carry on their essential activities. And thus, if a nation tries to prevent its enemy from receiving munitions, it is compelled to stop nearly all trade with neutrals; in other words, nearly all things can justifiably be now classed as "conditional contraband."

Many will remember how our Government delayed to declare, as contraband, cotton from the United States sent to Central Europe. The cotton which was sent ostensibly for the clothing necessities of the civilian population, and never previously regarded as contraband, had become, through the development of technical science, an important and almost vital necessity for the

manufacture of high explosives. From the cereals wanted for food the acetone required for cordite was made on a large scale during the War by a process that was little more than a laboratory exercise before 1914.

Transmutations of this sort that are now possible by the modern development of science have changed the whole question of contraband in international law. Thus, trade in those materials that can be turned to war account as munitions, cannot be stopped unless we run the danger also of starving civilians, or of endangering their essential supplies of clothing, and even of medical supplies; and this danger is important to realise because privations of the sort create sympathy among neutrals, and so incur the risk of an extension of the war area.

Interference on a necessary scale with ordinary civilian trade between a neutral and an enemy is followed by the usual financial troubles of a kind that tend to turn the neutral into an enemy; at any rate, it destroys the value of the neutral as a source of money; and the power of those who have money to lend during war time is so great that any such proposal as the "economic sanctions" prescribed by the League of Nations must obviously break down if any two Great Powers should go to war. This is evidently one of the weak features of the machinery devised by the League of Nations.

The League of Nations

It can be claimed for the League that it has been so far a greater success than any previous scheme for the prevention of war. Its frequent meetings for the institution of a common understanding regarding such questions as the trade in noxious drugs, conditions of labour and other social problems, have indirectly done as much good as its direct work in dealing with about half-a-dozen serious incidents of a kind that might have led to war—probably would have led to war—if no such machinery as the League's Council had existed.

So far the evidence is favourable, but it must be admitted that the League has not yet been faced with any serious dispute between first-rank Powers. And if it were so compelled to use any such measure as a blockade to carry out its sole restraining instru-

ment of economic boycott, there would be developed internal stresses in the organisation, probably well beyond its elastic limit, with resulting strain and possible fracture.

If any Member of the League breaks its covenant to keep off war for the prescribed six-plus-three months of negotiations, the other Members can join in severing economic and financial relations with it. Just think for a moment what that would mean to the World's commerce; think of the financial pressure that would be put on their Governments; think of the jealousies aroused by seeing some neutral State establishing new connections in the markets previously occupied by those who are compelled to abandon them for the sake only of a principle; think of the possibility of any one State finding some legal loophole to its own satisfaction to show that the offending Nation did not actually in legal terms declare war, but acted in self-defence; for in nearly every instance of war there is some justifiable difference of opinion about who started it. If any one of the large family of nations considered it necessary to support the alleged offender, *that* one would secure some economic or financial advantage, and so others too would naturally find similar excuses. That there is a real danger in this way of the so-called economic sanctions proving ineffective is admitted by many far-seeing supporters of the League.[10]

The Pact of Paris

Although the United States' Senate refused to ratify President Wilson's policy to accept the Treaty of Versailles and therefore

[10]The "sanctions" of the League and their process of enforcement are contained in Article XVI of the Covenant, and are as follows:—

1. Should any Member of the League resort to war in disregard of its covenants under Articles 12, 13, or 15, it shall *ipso facto* be deemed to have committed an act of war against all other Members of the League, which hereby undertake immediately to subject it to the severance of all trade or financial relations, the prohibition of all intercourse between their nationals and the nationals of the covenant-breaking State, and the prevention of all financial, commercial or personal intercourse between the nationals of the covenant-breaking State and the nationals of any other State, whether a Member of the League or not.

2. It shall be the duty of the Council in such case to recommend to the several Governments concerned what effective military, naval or air force the Members of the League shall severally contribute to the armed forces to be used to protect the covenants of the League.

3. The Members of the League agree, further, that they will mutually support one another in the financial and economic measures which are taken under this Article, in order to minimise the loss and inconvenience resulting from the above measures, and that they will mutually support one another in resisting any special measures aimed at one of their number by the covenant-breaking State, and that they will take the necessary steps to afford passage through their territory to the forces of any of the Members of the League which are co-operating to protect the covenants of the League.

the Covenant of the League of Nations, a movement to establish treaty obligations for ensuring peace developed independently, and finally took the form of a multilateral treaty for the renunciation of War as an instrument of national policy. This treaty, known as the Pact of Paris and more popularly, as the Kellogg Pact, has now been adopted by some 56 nations, being ratified by the United States' Senate on the 15th of January, 1929.

The Pact of Paris prescribes no form of compulsion, such as that included in the Covenant of the League, but in the moral sense it goes further in renouncing war as a national policy. Its instrument of force is what General Smuts has called a moral sanction. Its prompt adoption may be accepted as testimony to the remarkable progress made by the League of Nations in getting the nations to think in terms of peaceful settlement instead of by threat of arms. The activities of the League's Council and of the International Court of Justice have been acting during the past few years as a lightning conductor, quietly drawing off the electricity, and so reducing the potential of electrified war clouds. But a lightning conductor is of little use in an actual thunderstorm; and so, too, neither the League nor the Pact of Paris would prove to be effective in an actual war, whilst enforcement of the well-discussed Article XVI might actually convert a local into a world war.

The Proposed Mineral Sanction

The real problem is to discover some instrument which can be used promptly, without interfering with food, clothing or other civil necessities; some measure that can be adopted with the minimum of interference with commerce and finance; some form of prohibition that cannot arouse international jealousies by the usurpation of deserted markets. We want some instrument as simple as taking away the sparking plugs of a road-hog motorist, without otherwise damaging his car; something of the kind that makes the increase or decrease of navies a matter of relatively small importance; something that can temporarily paralyse the most powerful navy, if necessary, without interfering with trade, or otherwise damaging the fleet; something indeed that will force any nation to appeal to the League of Nations before much blood

is spilt; some embargo so obviously effective that no nation will even attempt mobilisation.

It is obvious, from what has been said about the power of science to transmute one product to another, that the whole class of organic materials must be ruled out as dangerously unreliable; but science has not yet been able to transmute metals, and cannot manufacture any substitutes for most of the minerals that are essential in war. So far as we can see, it will never succeed in these respects for some generations, if ever, at any rate on a war scale.

Thus, it seems worth while to explore the possibility of finding in the mineral world some kind of "sparking plug" that is essential to the military and naval "car," and one that can be withheld from any nation that may break the pact of peace. If we can do this without disturbing the ordinary commercial and financial currents of the world, we may be able to force the offender to go to Geneva at once and so give time for the hot blood to cool down.

By recalling the lists of outstanding deficiencies already given for the leading Great Powers, it will be obvious that Germany, France, Italy and Japan would never risk a war-venture if there were any danger of the other nations acting in concert to refuse supplies of the specified minerals; indeed, there would be serious dangers of unknown dimensions if only a small number of other nations refused supplies. It would be a rash venture for any Power to undertake a war if either the British Empire, or the United States refused to permit the export of minerals to the adventurer; and any country that attempted to break the Pact of Paris would be paralysed if these two agreed to withhold mineral supplies.

It is suggested, therefore, that each country should add a simple rider to its treaty with the United States, giving its Government the power, if and when necessary, to prohibit the export of mineral products to any country that breaks the peace with any other member of the Pact. The very existence of any such power would be in itself sufficient automatically to enforce submission of the matters in dispute to the International Court of Justice.

This suggestion in no way clashes with Article XVI of the League's covenant; the more serious obligations of the "economic

sanctions" may be allowed to stand as an ultimate instrument to be enforced if necessary. On the contrary, what may be called the "mineral sanction"[11] would be in effect a first stage of the so-called economic sanctions, but it would not involve a general upset of the World's commerce and finance; it would not seriously affect the prices of civil necessities, even in the country that is penalised; trade in all commodities, except in minerals, would continue with all countries, and even in minerals with all countries except one, for export would be safe to all countries that adhere to the multilateral treaty; no one of them would re-export to the refractory nation.

An agreement of this sort requires no military or naval machine for its enforcement. There is a fundamental difference between the methods of controlling exports and imports, for illicit imports are possible only when exports are free and uncontrolled elsewhere—a circumstance now well appreciated across the Atlantic. The smuggling of minerals outward in a general cargo could not be successful on any scale of importance to a serious war, in which munitions are not only necessary in quantity, but with certainty and regularity to fit with plans for military operations.

The objections to the suggested scheme can be met by two-counter questions:—Why insist on "the severance of all trade or financial relations, and the prohibition of all intercourse between their nationals," when a much simpler prohibition is sufficient? Why "recommend to the several Governments concerned what effective military, naval or air force the Members of the League shall severally contribute to the armed forces to be used to protect the covenants of the League," when the Port Officers can readily stop any War with no further force than refusing "port clearance" to any ship carrying minerals to the covenant-breaker?

The "economic sanctions" of the League may stand as an ultimate resort; but some simpler method that can bring the "covenant-breaking State" to reason is quite sufficient, so long as it is in a form that all nations can agree to accept as a common measure. The proposed mineral sanction is one that offers—so far as one can foresee scientific and technological developments—relative permanence as well as simplicity; the trend of modern

[11] I am indebted to General J. C. Smuts for this term.

technology is in the direction of making mineral products not less but more definitely essential in future, first by the utilisation in the arts of further varieties, and then by their use on an increasing scale for the manufacture of both civil and military machinery. The tendency is in a direction that increases international dependence rather than the reverse. For example, until the end of the last century there was very little known of the ferro-alloys. Manganese-steel was first introduced by Sir Robert Hadfield in 1888, but it was only slowly that metallurgists discovered the remarkable effects of alloying iron with those metals that range in atomic number from 22 to 28—titanium, vanadium, chromium, cobalt and nickel, as well as with the heavier metals molybdenum and tungsten. Our knowledge of these alloys and their properties is still rapidly developing, with consequent changes in mechanical designs and with increased variety of use. No branch of applied science appears to be making more rapid progress just now than the metallurgy of alloys, which shows a tendency to utilise a wider range of metals, with increased range of applications to the arts of peace and war.

The utilisation of some minerals that were previously of nominal value is not being followed by the disuse of others; for output is increasing in quantity more rapidly than it is extending in variety; and so mineral deposits that till recently were of little value are becoming of international importance, just as mechanical luxuries mechanically become mechanical necessities.

It is advisable to anticipate one inevitable form of criticism, and that is the possibility of any nation accumulating stocks as an insurance against a probable shortage during war. Among the objects which the Leith Committee had in view was that of ensuring security to the United States in time of national emergency. The Sub-Committee on antimony recommended the accumulation of a stock of 4,000 tons by the Ordnance Department, whilst that on manganese-ore recommended the accumulation of not less than 600,000 tons to be held "at a suitable location for tiding over a war emergency." Without making proposals as definite as these, the other Sub-Committees on special minerals also discussed measures for obtaining security during war.

But this line of thought was not pursued further by the Leith

Committee as a whole; they devoted themselves mainly to the commercial influences of the after-war tendency towards a narrow and exclusive form of nationalism.

As a result of our discussion of these questions at the Institutions in London and at the Empire Congress in Canada during 1927, it became obvious that any attempt to accumulate stocks as a safeguard against war-time embarrassments must prove to be impracticable. The increases of consumption which occurred during the Great War varied for different minerals, but were so greatly in excess of peace-time industrial needs for most of them, that the stocks required to ensure any substantial degree of security would incur the lock-up of larger sums than any legislature would tolerate. Stocks on a war-time scale, also, would be so much in excess of normal consumption that they would be regarded by the commercial world as a constant menace to prices, tending to discourage enterprise in production because of the vague fear of the unloading stocks in consequence of a change in policy, or of a change in the estimates of war necessities. The shortcomings of most nations, due to their unequal and unalterable resources, are too large and too varied for any such form of artificial re-adjustment. As already stated, the whole tendency of technical evolution is in the direction of widening, instead of restricting, the variety and quantity of mineral products that are necessary to meet industrial demands and therefore also of war munitions. Any nation that contemplates war in future must first count the cost in minerals; beyond question the possession of a full supply of the essential minerals is, above all, the controlling factor in problems of strategy.

Critics will notice also that this project requires general acceptance to be fully effective; otherwise, it would be liable to evasion by export to any neutral country, with re-export to a belligerent. This applies equally to the Capper scheme referred to later; if the United States refused to supply munitions to any nation which breaks the Pact, some, but not complete, embarrassment would follow, and still more if the United States and the British Empire combined to refuse mineral products by direct export. The essence of the scheme requires free and full commercial relations with all those nations in the Pact, on the understanding that none

who is loyal will re-export mineral products to the provocative belligerent.

The Capper Resolution

The suggestion that the newly developed configuration of the mining and metallurgical world offers a means for making effective the treaties recently signed to secure peace, was first made last July as a by-product of my Presidential Address to the British Association. The proposal was drafted before my departure for South America early in the year; but on my return, preparatory to starting for South Africa, I found that Senator Arthur Capper of Kansas had introduced into the United States Legislature a resolution inspired by a similar principle, extended, however, to include munitions of all sorts; and his formal priority for any proposal of the sort was acknowledged by a revision of the last page of my Address before its delivery.

The essential substance of Senator Capper's resolution is contained in the paragraph which reads as follows:—

> "That whenever the President determines and by proclamation declares that any country has violated the Multilateral Treaty for the Renunciation of War, it shall be unlawful, unless otherwise provided by act of Congress, or by proclamation of the President, to export to such country arms, munitions, implements of war or other articles for use in war until the President shall by proclamation declare that such violation no longer continues."

There is obviously an important difference between our two proposals, which will be recognisable from the remarks made earlier in this lecture regarding the similarity which has recently developed between the nature of civil supplies and munitions of war; there is the circumstance, too, that some *materials* which are essential for one purpose can be converted to *articles* that are required for the other. Indeed, Senator Capper leaves us with the old difficulty of defining "munitions of war," of distinguishing between "contraband" and "conditional contraband." His resolution also, although in this way wider, covers less ground than my proposed amendment, because it permits the export of articles which are obviously not for use in war in their exported form, but which, when made of metal, can readily be converted to war

use, even as lethal weapons. "Plowshares" made of nickel-steel and "pruning hooks" of the tungsten alloy will be in great demand when required to reverse the ancient prophecy of universal peace, a prophecy which was similarly made independently by two prophets long before ferro-alloys and high explosives were dreamt of.

I have accordingly suggested an amendment to the Capper resolution, using the simple words "mineral products" as sufficient when controlled to stop a war if already started; and, because of its minatory form, sufficient effectively to restrain any nation that may be tempted to disregard its treaty obligations. All lethal munitions that one could think of as possible are wholly, or mainly composed of "mineral products" in some form. A closer scrutiny of the list might even narrow the prohibition to a relatively short list of metals and other mineral products; still, as international agreements are slow to make and equally difficult to rectify, it is better to accept the crude comprehensive group as a rider that is sufficiently wide to be effective, but yet restricted enough to reduce so far as is safe that degree of disturbance to commerce and finance which may tend to widen the area of dispute.

The Hurley Scheme

During the past two months a third proposal of the same generic type has been made by Mr. Edward N. Hurley, of Chicago, in a letter, dated 20th November, 1929, addressed to the President of the International Chamber of Commerce. Mr. Hurley outlines a "plan for the permanent abatement of warfare among nations through the control of the raw materials without which modern wars cannot be carried on." He points out that "any modern nation could be paralysed by the refusal of business organisations in the other countries to sell to it ten or twelve essential raw materials, such as iron-ore, rubber, manganese, nickel, aluminium, newsprint pulp, copper, oils, tungsten, chromium and mercury."

This list of eleven examples of "essential" raw materials significantly includes nine mineral products; and of the other two, rubber, not being a mineral, is threatened with a synthetic substitute, whilst judicious restriction of the one remaining substance might even be imposed advantageously for the more peaceful enjoyment of peace. Mr. Hurley tells me that he failed to notice

till last month that a similar proposal was made in my Address to the British Association. The copy of his letter now received shows that he has been independently following the same line of thought; but, instead of asking the governments to sign an agreement, he suggests that an understanding among leaders of commerce would provide an effective restraint of martial fervour; and, with this object in view, he wishes his proposals to be discussed at the next international meeting of the Chambers of Commerce. The fact that an agreement among the leading producers of raw materials could be supported also by other commercial leaders who are controllers of transport and finance may tend to reduce possibly to an effective degree some of the efforts of any lineal descendant of "bootleggers" who are likely to be incubated in a warm war atmosphere.

Whether any such agreement among leaders of commerce and industry can be effected must be left to the Chambers of Commerce to decide, but it is clear that Mr. Hurley has discovered independently a method essentially similar in nature to that which I have attempted to describe. Obviously, a self-denying ordinance among the limited class of capitalists will be regarded with less confidence than treaty obligations made by responsible Governments. There is also a danger that a measure designed to paralyse the financial operations of a nation and to refuse transport facilities may lose in value, and even fail in operation, because it goes too far by striking at common civil necessities. If the car can be immobilised by the removal of its replaceable sparking plugs, there is no necessity to empty the petrol tanks and to puncture the tyres as well.

Summary

It is necessary to recognise the circumstance that the principal mineral deposits are distributed in the earth's crust over areas that do not coincide with the established national boundary lines.

During the past few years the use of metals and of other mineral products which followed the mechanisation of industries has enormously increased in variety and in quantity, with the result that no industrial country is now self-contained, and the national interchange of mineral products is inevitable.

As this national interdependence for minerals tends to increase, our fiscal relationships should be adjusted for the general benefit of civilised communities and for the purpose of reducing the causes of international friction.

These considerations have been urged especially by Professor Leith in the United States; and the chief object of this paper is to propose that advantage be taken of the situation as a means for enforcing the recently developed international understandings and treaties designed to renounce war as an instrument of international policy.

It is obvious that if the Arts of Peace necessitate the international movements of minerals, modern warfare cannot be conducted without even greater quantities and wider varieties of such products. To accumulate stocks in anticipation of a war is shown to be impracticable. It is therefore proposed that all nations that have signed the Kellogg-Briand Pact of Paris should be invited to add a rider, giving the Government of each the authority, if and when necessary, to prohibit the export of mineral products to any nation that violates the multilateral treaty.

The scheme could be initiated by agreement between the British Empire and the United States, which between them own some two-thirds of the known workable deposits of minerals and commercially control some three-quarters.

Any such agreement would effectually stop a war if rashly commenced; and because of its minatory spirit, would enforce a more general consideration of the peaceful means for settlement which are provided by the Council of the League of Nations and International Court of Justice.

The plan proposed would not interfere with the general conditions of international commerce and finance, except as regards mineral products between the rest of the signatories of the Pact of Paris and the pact-breaking nation; for re-export would not be possible from those that are loyal to the treaty. It would not interfere with the trade required for the civil necessities of any nation, and thus would reduce to a minimum the aftermath of reparation disputes. In this respect it evades the dangers which are inherent in Article XVI of the Covenant of the League of Nations.

It is hoped that any agreement of the kind will facilitate measures for reducing armaments and other conditions that now retard the development of a national policy towards peace, a policy which should be logically an obligation following the recent general declaration of good intentions to eschew war. The problem of reducing armaments would become more readily soluble if we could first be absolutely sure of security. The Powers could then discuss the question in a wholly different atmosphere. Each would then be free to recognise that the others have unlike responsibilities in distant parts of the World, where the League of Nations is not recognised and where the Pact of Paris is regarded as an immoral interference with a recognised form of sport. Parity of armaments at home is not mathematically correct until the tonnage or other accepted unit of measurement be divided by the unit of responsibility for geographically distant obligations.

TABLE

Average annual production of some leading minerals for the years 1926–28, quoted to show the dominating producers.

	World's Total	Country	Output	Per Cent. of World's Total
	tons	China	21,000	65.5
Antimony	32,000	Bolivia	3,909	12.2
	tons			
Asbestos	363,000	British Empire	332,000	90.7
	tons	British Empire	250,000	63.0
Chromite	397,000	S. Rhodesia	184,119	46.4
	tons	U.S.A.	780,600	50.1
Copper	1,557,000	British Empire	113,000	7.2
		Japan	66,628	4.3
	ounces			
Gold	19,300,000	S. African Union	10,143,839	52.6
Pig-iron	tons	U.S.A.	37,360,680	
(1927, 1928)	86,400,000	Germany	12,249,987	
		France	9,474,956	78.0
		Gt. Britain	6,951,500	
		Canada	924,480	
	tons			
Lead	1,983,000	U.S.A.	583,309	29.4
Manganese-ore	tons	India	1,072,140	37.6
(1926, 1927)	3,900,000	Gold Coast	392,883	
	tons			
Nickel	37,700	Canada	34,117	90.5
	tons			
Petroleum	167,467,000	U.S.A.	115,922,404	69.0
	tons	Germany	1,401,269	94.0
Potash	1,880,000	France	377,289	
Quicksilver	lbs.	Spain	5,496,121	50.0
(1927)	11,000,000	Italy	4,400,426	40.0
	tons	British Empire	73,133	45.7
Tin	160,000	Malaya	55,524	34.3
	tons	U.S.A.	649,079	39.3
Zinc	1,650,000	British Empire	325,300	19.7

LIST OF PUBLICATIONS

International Conciliation appeared under the imprint of the American Association for International Conciliation, No. 1, April, 1907 to No. 199, June, 1924. These documents present the views of distinguished leaders of opinion of many countries on vital international problems and reproduce the texts of official treaties, diplomatic correspondence and draft plans for international projects such as the Permanent Court of International Justice. The most recent publications are listed below. A complete list will be sent upon application to International Conciliation, 405 West 117th Street, New York City.

253. The Reparation Settlement, Signed June 7, 1929 with Historical and Explanatory Introduction, by Dr. Leon Fraser, Formerly the General Counsel of the Dawes Plan.
October 1929.

254. The Permanent Court of International Justice: American Accession and Amendments to the Statute, by Philip C. Jessup.
November, 1929.

255. Observations on Present-day Russia. The Culture Program of Soviet Russia, by Paul Monroe. Articles reprinted from *The Round Table* and a Translation from the *Revue des Deux Mondes*.
December, 1929.

256. The First Ten Years of the League of Nations, by Arthur Sweetser.
January, 1930.

257. British Arbitration Policies, by Norman L. Hill, Associate Professor of Political Science, University of Nebraska.
February, 1930.

258. Documents Concerning the Origin and Purpose of the Indian Statutory Commission.
March, 1930.

259. The Eighth Year of the Permanent Court of International Justice, by Manley O. Hudson, Bemis Professor of International Law, Harvard Law School.
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260. The Kyoto Conference of the Institute of Pacific Relations, by Chester H. Rowell.
May, 1930.

261. The Soviet and Religion: Debate in the British House of Lords, April 2, 1930; Decree of the All-Russian Central Executive Committee and Soviet of the People's Commissaries of the R.S.F.S.R., April 8, 1929; Protest of His Holiness Pope Pius XI against Religious Persecution in Russia, February 2, 1930.
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262. The Final Settlement of the Reparations Problems Growing Out of the World War. Protocol, with Annexes, Approved at the Plenary Session of The Hague Conference, August 31, 1929 and Agreements Concluded at The Hague Conference, January, 1930.
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263. Memorial to Gustav Stresemann. Address by Dr. Julius Curtius, German Minister of Foreign Affairs, to the People of the United States, June 21, 1930, and Related Material.
October, 1930.

264. The attempt to Define Aggression, by Clyde Eagleton, Associate Professor of Government, New York University.
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265. European Federal Union. Replies of Twenty-Six Governments of Europe to M. Briand's Memorandum of May 17, 1930.
December, 1930.

266. Minerals and International Relations: The International Relationship of Minerals and International Movement of Mineral Products in Peace and War, by Sir Thomas H. Holland, K.C.S.I., K.C.I.E., D.Sc., LL.D., F.R.S., Vice-Chancellor and Principal of Edinburgh University.
January, 1931.